

A SURVEY OF LONG LAKE FISH COMMUNITY AND LARGEMOUTH BASS
POPULATION
Steuben County
2008

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EXECUTIVE SUMMARY

- A general fisheries survey was conducted on Long Lake on June 2 through 5, 2008. Water chemistry and aquatic vegetation data were also collected.
- A largemouth bass population estimate was conducted on Long Lake for a period of three consecutive weeks beginning on May 1, 2008. The total largemouth bass population estimate for the lake was 3,884 fish, or 25.2/acre. The estimate for stock size bass (8.0 in TL or larger) was 3,676 or 23.9/acre.
- The Secchi disk reading at Long Lake during the general survey was 7.5 ft and dissolved oxygen concentrations were not adequate for fish survival below 19 ft. The Secchi disk reading during the plant survey was 6 ft. Submersed vegetation was found to a maximum depth of 12 ft. Coontail was the most common submersed plant followed by eel grass and large-leaf pondweed. Fifteen species of submersed plants were collected during the survey. Two exotic invasive plant species, curly-leaf pondweed and Eurasian watermilfoil, were found.
- A total of 1,265 fish representing 16 species was collected during the general survey. Bluegills ranked first by number, followed by redear, yellow perch and largemouth bass. Gizzard shad was the dominant species collected by weight followed by largemouth bass, redear and yellow perch
- Bluegills, redear, yellow perch and largemouth bass dominated the sport fishery at Long Lake while black crappies contributed, although they were present in lesser numbers.
- Bluegills, redear, yellow perch and largemouth bass of all ages grew at an average rate for northern Indiana natural lakes with the exception of age-1 largemouth bass which grew at an above average rate.
- The increased abundance of gizzard shad in Long Lake fish community may pose a threat to the health of the bluegill population in the lake. District 2 biologists should conduct periodic electrofishing surveys at the lake in an effort to detect any significant changes in bluegill size structure and growth while also monitoring shad recruitment and abundance.
- Curly-leaf pondweed control could be beneficial for Long Lake anglers/boaters. If interested, representatives from a lake association should contact District 2 biologists or a member of the LARE staff to obtain information on control and funding opportunities.

INTRODUCTION

Long Lake is a 154-acre natural lake located approximately six miles east of Fremont, Indiana in Steuben County. It has an average depth of 12 feet and the maximum depth is 36 feet. Approximately 80% of the shoreline is developed residentially and the remainder is undeveloped. There are no inlets to Long Lake. The outlet is located in the southwest corner of the lake and flows into Mirror Lake. A fixed crest, steel sheet piling water control structure regulates the flow from the outlet. There is a public access site with a concrete boat ramp located on the north shore of the Michigan portion of the lake. This site is owned and operated by the Michigan Department of Natural Resources. A reciprocal fishing agreement between Indiana and Michigan exists on Long Lake. Residents of Indiana or Michigan possessing a valid resident fishing license can fish anywhere on the lake. Residents of states other than Indiana or Michigan must possess a valid non-resident fishing license for the state having jurisdiction over that portion of the lake in which they are fishing. All anglers must follow the state regulations for the portion of the lake they are fishing in, including possession of a species during a closed season and size or bag limits. For example, if an angler is fishing in Indiana waters of the lake during Michigan's closed bass season and takes a bass, then returns to the ramp located in the Michigan portion of the lake to take out his boat with the bass still in his possession, he is violation of the closed bass season in Michigan.

Long Lake was hydrographically surveyed in 1962. A fisheries survey of the lake was conducted in 1985 by the Michigan Department of Natural Resources. Fisheries biologists from the Indiana Department of Natural Resources, Division of Fish and Wildlife (DFW) first surveyed Long Lake in May of 1992 to evaluate the condition of the sport fishery (Table 1). . Sampling methods consisted of gill netting, trap netting and nighttime D.C. electrofishing. The results of this survey indicated the presence of a good sport fishery, although there was some concern about the condition of the largemouth bass population. At the time of the survey there was a minimum bass size limit of 12 inches in effect on the Indiana portion of the lake and a 14 inch size limit on the Michigan portion of the lake. Electrofishing catch rates for bass were extremely high during this survey as 326 were collected during one hour of electrofishing. However, only 4.3% of these measured 12 in TL larger which was legal size in Indiana. Age-3 and younger bass grew at an above average rate for northern Indiana natural lakes, but bass weights per length were below average.

METHODS

The general fish community survey was conducted on June 2 through 5, 2008 as part of DFW Work Plan 204755 that covers management of fish populations in natural lakes. Several physical and chemical characteristics of the water were measured in the deepest area of the lake according to the Manual of Fisheries Survey Methods (2001) standard lake survey guidelines. Submersed aquatic vegetation was sampled on July 15, 2008 using methods outlined in the Tier II Aquatic Vegetation Survey Protocol developed by the DFW Lake and River Enhancement Program and used in their aquatic vegetation control grant program. A global positioning system (GPS) device was used to record the location of the limnological data collection site, aquatic vegetation sample sites, and fish collection sites.

Fish were collected by pulsed D.C. electrofishing the shoreline at night with two dippers for 0.75 hours. One trap net and two experimental-mesh gill nets were fished overnight for three nights. All fish collected were measured to the nearest 0.1 in TL. Length-weight regression equations for Fish Management District 2 were used to estimate the weight of all fish within the sample. Five scale samples per half-inch group were collected from game species for age and growth analysis. Average length-at-age for these species was estimated using the Fraser-Lee method of back calculation and standard intercepts (DeVries and Frie 1996, Carlander 1982). Age-length keys were also constructed to determine mean length at age at the time of collection.

A largemouth bass population estimate was also conducted at Long Lake in the spring of 2008. Sampling effort consisted of three nights of pulsed D.C. electrofishing using two dippers and totaling 5.5 hours over a three week period. The entire shoreline was covered each night. Only largemouth bass were collected and all of these fish were measured to the nearest 0.1 in TL and marked by removing a fin. The number of bass that were re-captured on subsequent nights was recorded and a population estimate was made using the Schnabel method. Analysis of largemouth bass abundance concentrated on stock size fish which is the main size group used for comparative purposes in scientific literature. In addition, fish smaller than stock size are often times collected in low numbers, making recapture difficult which in turn results in unreliable estimates of abundance. The stock size for largemouth bass is any fish 8.0 in TL or larger.

RESULTS

The Secchi disk reading at Long Lake was 7.5 ft. Dissolved oxygen concentrations were inadequate for fish survival below 19 ft. A total of 50 sites were randomly sampled during the plant survey, 42 of which fell within the littoral zone in water 12 ft in depth or less. A total of 13 native and 2 exotic species were identified. Aquatic plants were observed at all of the 42 littoral sites sampled. The maximum number of plant species found at one site was eight and the mean was two. Coontail dominated the plant community, followed by eel grass, large-leaf pondweed and curly-leaf pondweed. In addition to curly-leaf pondweed, one other exotic invasive species, Eurasian watermilfoil, was collected during the survey. Five emergent, floating or floating leaf plants associated with wetlands including cattails, spatterdock, arrowhead, purple loosestrife and white water lily, were also observed.

A total of 1,265 fish weighing 475 pounds were collected during this survey. Sixteen species were represented in the sample. Bluegills dominated the sample by number (24%) followed by redear (17%), yellow perch (16%), and largemouth bass (9%). Gizzard shad was the number one species collected by weight (21%), followed by largemouth bass (18%), redear (15%) and yellow perch (10%).

Bluegills ranked first among all species collected by number (24%) and sixth by weight (7%). They ranged in length from 1.3 (age 1) to 8.0 (age 6) in TL and averaged 4.7 in TL. A total of 304 bluegills weighing 33 pounds were in the sample. The electrofishing catch rate for bluegills was 388 fish/hour. Gill netting yielded 2 bluegills/lift while trap nets caught 1 bluegill/lift. Harvestable size bluegills (6 in TL or larger) comprised 24% of the sample and reached this size during their third or fourth year of life. Approximately 9% were 7.0 in TL or larger while only one 8.0 in TL or larger bluegills was collected. All ages of bluegills grew at an average rate for northern Indiana natural lakes. Over 75% percent of the bluegills collected in 1992 were harvestable size. Bluegills 7in TL and larger comprised 59% of the sample that year, while 8-in TL or larger bluegills comprised 24% of the sample. It should be pointed out that only 68 bluegills total were collected in 1992.

A total of 215 redear weighing 69 pounds were collected during this survey. Redear were second in abundance and ranked third by weight among species collected during this survey. They ranged in length from 4.9 (age 3) to 9.5 (age 6) in TL and averaging 7.2 in TL. Harvestable size redear (6 in TL or larger) comprised 92% of the sample and reached this size

during their third or fourth year of life. In addition, approximately 29% were 8 in TL or larger. The electrofishing catch rate for redear was 39 fish/hour. Gill netting yielded 1 redear/lift and trap netting 61 redear/lift. All ages of redear grew at an average rate for northern Indiana natural lakes. All but 4 of the 272 redear collected in 1992 (98%) were harvestable size.

Yellow perch were the third most abundant fish by number (16%) and fourth by weight (10%) collected during the survey. A total of 208 perch ranging in length from 5.7 (age 3) to 12.0 (age 6) in TL and averaging 7.4 in TL were captured. Perch measuring 8.0 in TL or larger (harvestable size) comprised 35% of the sample while 4% measured 10.0 in TL or larger. They grew at an average rate for northern Indiana natural lakes and reached harvestable size during their fourth year of life. Perch were abundant during the previous survey also as 248 comprising 18% of the sample by number were collected. Approximately 88% of the 1992 perch sample was harvestable size and 14% was 10.0 in TL or larger.

Largemouth bass was the number one sport species collected by weight and ranked second overall by weight, as a total of 137 bass weighing 87 pounds were collected during the general fisheries survey. By number, bass comprised 11% of the sample which was fourth highest. They ranged in length from 3.7 (age 1) to 18.1 (age 9) in TL and averaged 10.0 in TL. Legal size bass, those fourteen in TL or larger, comprised 11% of the bass sample and reached this size during their fourth or fifth year of life. Approximately 3% of the bass collected measured 16 in TL or larger. The electrofishing catch rate for largemouth bass was 168 fish/hour. Gill netting yielded 2 bass/lift while none were collected in trap nets. Age-1 largemouth bass grew at an above average rate for northern Indiana natural lakes while all other ages of bass grew at an average rate. In 1992, a total of 326 largemouth bass were collected in one hour of nighttime electrofishing. Only two of these bass measured 14 in TL or larger, a 14.6 in TL fish and a 16.4 in TL fish.

A total of 109 gizzard shad ranging in length from 12.8 to 18.5 in TL and weighing 100 pounds were captured during this survey. Shad are recognized as an undesirable species as they compete heavily with panfish for food resulting in slow growing panfish populations containing few large individuals that are attractive to fisherman. Shad were present in the previous Long Lake survey but only 20 individuals were collected. Since the shad were primarily large individuals it is probable the majority were from a single year class that may be reaching the end

of their life span. The lack of smaller shad in the sample indicates the bass population density may be sufficient to keep them in check through predation.

Ninety black crappies weighing 23 pounds were collected during the survey. They ranged in length from 3.3 (age 1) to 11.2 (age 5) in TL and averaged 7.7 in TL. Harvestable size crappies (8.5 in TL or larger) comprised 14% of the sample, reaching this size at age 3. Only 36 crappies were collected in 1992.

During the largemouth bass population estimate sampling, a total of 1,250 bass were collected. This resulted in a total population estimate of 3,884 bass, or 25.2/acre. When discussing bass populations, comparisons are more relevant when considering only stock size fish. The stock size for largemouth bass is any fish 8.0 in TL or larger. The stock size bass population was estimated to be 3,676 fish or 23.9/acre (Table 3). Approximately 19% of the bass collected measured 14 in TL or larger which is legal size. In addition, 9% were 16 in TL or larger while 3% were 18 in TL or larger. The estimated number of legal size largemouth bass in Long Lake was 738 fish or 4.7/acre. It was also estimated that 18 in TL or larger bass were present at a density of 0.9/acre. The largest bass collected during the Long Lake population estimate study measured 20.7 in TL.

DISCUSSION

Long Lake supports a good sport fish community comprised primarily of bluegills, redear, yellow perch and largemouth bass. Together these species represented 68% of the general survey sample by number and 50% by weight. In addition, black crappies are present in sufficient sizes and numbers to be of interest to Long Lake anglers.

Bluegill was the top species by number (24%) with 304 collected during the survey. The percentage of harvestable size bluegills in the current survey was much lower than what was present in the 1992 survey (24% and 75% respectively). On the surface, this would appear to be a startling decline. However, when taking into account the relatively small size of the bluegill sample in 1992 (68 fish) it is difficult to say conclusively that the number of harvestable size fish in the fishery has declined significantly. In fact, when looking at the raw numbers, there were more harvestable size bluegills collected during this survey (73) than in 1992 (54). The major difference in the population structure between the two samples lies in the age-2 and age-3 fish. In 1992, age-2 and age-3 bluegills ranged from 2.5 to 6.0 in TL and comprised 18% of the

sample. In 2008, while the size range of these two age groups was identical to 1992, the percentage by number increased to 66%. This increase in the number of age-2 and age-3 bluegills in the population should lead to the presence of more harvestable size fish in the future if they continue to grow at the current average rate.

Redear and yellow perch ranked second and third in abundance respectively, combining to comprise 33% of the fish sample. Approximately 92% of the redear were harvestable size with individuals up to 9.5 in TL present, similar to the 1992 sample. Perch are present in good numbers in Long Lake although there was a decline in the percentage of harvestable size fish collected. However, perch growth is still average and they should continue to make a good contribution to the fishery.

A good largemouth bass fishery is present at Long Lake. An unusually large number of bass were collected during the general survey in 1992 (326) but this declined to 137 during the current survey. However, an increase in the number of 14 in TL or larger bass accompanied the decrease in the total number of bass collected, going from 2 in 1992 to 12 in 2008. Bass measuring from 9.5 to 11.0 in TL dominated the 1992 sample as 233 comprising 71% of the sample were collected. In contrast, only 35 bass (26%) in this size range were in the 2008 sample.

The spring population estimate presents a much clearer picture of the status of the largemouth bass fishery in Long Lake. A total of 1,250 bass were collected in this sampling resulting in a population estimate of 3,884 bass of which 3,676 were stock size (23.9/ac). Previous bass sampling in medium size Indiana natural lakes (100 to 499 acres) following imposition of a 14 in TL minimum size limit yielded average population estimates of 20.8 stock size bass per acre (Pearson 2003). Legal size bass (14 in TL or larger) comprised 19% of the sample. This resulted in an estimate of 4.7 legal size bass per acre present in Long Lake, slightly more than one bass per acre better than the average for medium size natural lakes in Indiana (3.5/ac). In addition, the estimated number of 18 in TL or larger bass at Long Lake is much higher than the average, 0.9 bass per acre compared to 0.3.

Gizzard shad appear to have increased in number at Long Lake. While shad do provide good forage for bass when they are small, they are notorious for impacting bluegill populations by out-competing them for food resulting in diminished growth for the bluegills. Age and growth analysis of the 2008 bluegill sample indicates that growth has not yet declined, however

this situation merits future investigations in order to monitor the condition of the bluegill population as well as new shad recruitment.

A diverse community of aquatic vegetation is present at Long Lake, dominated by coontail, eel grass and large-leaf pondweed. Eurasian watermilfoil and curly-leaf pondweed, two exotic species, were present. However, at the time of the plant survey they presented no problem for anglers. During the bass population estimate it was noted that curly-leaf pondweed density was high in the lower bay on the west side of the lake, making navigation throughout the bay difficult. This plant reaches peak growth early in the season and dies off as the water warms, oftentimes making it difficult to detect if plant sampling is done late in the summer.

Long Lake residents have been contracting for chemical control of up to 10 acres of nuisance plants annually, with 7.7 acres being treated in 2008. The DFW has a Lake and River Enhancement (LARE) section through which lake associations may apply for cost sharing for control of exotic invasive plant species. If Long Lake has such an organization, they may wish to take advantage of this opportunity in order to gain financial assistance with control of their curly-leaf pondweed.

Black spot disease was observed in yellow perch in Long Lake during this survey. This disease is the result of an infestation by a parasitic fluke which burrows under the skin of the fish. A black pigment then forms in the tissue surrounding the fluke as a reaction by the fish against the parasite. Despite its unsightly appearance, the parasite is harmless to humans. Shoreline erosion is minimal.

RECOMMENDATIONS

- The increased presence of gizzard shad in the Long Lake fish community may pose a threat to the health of the bluegill population. District 2 biologists should conduct periodic electrofishing surveys at the lake in an effort to detect any significant changes in bluegill size structure and growth while also monitoring shad recruitment and abundance.
- Curly-leaf pondweed control could be beneficial for Long Lake anglers/boaters. If interested, representatives from a lake association should contact District 2 biologists or a member of the LARE staff to obtain information on control and funding opportunities.

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Carlander, KD. 1982. Standard intercepts for calculating length from scale measurements for some centrarchid and percoid fishes. Transactions of the American Fisheries Society 111:332-336.

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Pearson, J. 2003. Indiana natural largemouth bass data set. Indiana Division of Fish and Wildlife. Indianapolis, In.

Submitted by: Larry A. Koza, Assistant Fisheries Biologist
Date: 2/11/09

Approved by: Stuart Shipman
North Region Fisheries Supervisor
Date: 2/27/09

Table 1. Sampling effort, species composition and relative abundance of fish collected during 1992 and 2008 fisheries surveys of Long Lake.

Species	1992	2008
Black crappie	36	90
Bluegill	68	304
Bowfin	9	
Brown bullhead	41	12
Channel catfish		1
Common carp	15	3
Gizzard shad	20	109
Golden shiner	65	10
Hybrid sunfish	5	
Lake chubsucker	108	78
Largemouth bass	326	137
Northern pike		4
Pumpkinseed sunfish	9	44
Redear sunfish	272	215
Redfin pickerel	17	10
Warmouth	73	15
White sucker	10	
Yellow bullhead	41	25
Yellow perch	248	208
Total	1363	1265
Sampling Effort		
Electrofishing Effort	1.0 h DC	0.75 h DC
Gill Net Effort	12 lifts	6 lifts
Trap Net Effort	8 lifts	3 lifts

Table 2. Catch by select size ranges for bluegill, largemouth bass and redear collected during 1992 and 2008 fisheries surveys of Long Lake.

Species	Length Range (TL)	1992	2008
Bluegill	3.0-5.5 in	11	214
	6.0-6.5 in	12	46
	7.0-7.5 in	24	26
	≥ 8.0 in	16	1
Largemouth bass	8.0-9.5 in	88	67
	10.0-11.5 in	198	23
	12.0-13.5 in	12	14
	14.0-17.5 in	2	13
	≥ 18.0 in	0	2

Table 3. Average number of stock size largemouth bass per acre in medium size natural lakes (100-499) acres in Indiana in comparison to Long Lake.

Size range (inches)	Average pre-size limit (21)	Average post-size limit (7)	Long Lake 2008
≥ 8.0 in	11.4	20.8	23.9
≥ 12.0 in	3.1	8.8	8.0
≥ 14.0 in	1.7	3.5	4.7



▲ Trap Net

Gill Net ●—●

Figure 1. Aerial photo of Long Lake with sample locations.

APPENDIX 1. General survey data page

LAKE SURVEY REPORT

Type of Survey
<input type="checkbox"/> Initial Survey
<input checked="" type="checkbox"/> Re-Survey

Lake Name	County	Date of survey (Month, day, year)
Long Lake	Steuben	June 2-5, 2008
Biologist's name	Date of approval (Month, day, year)	
Neil D. Ledet and Larry A. Koza	February 27, 2009	

LOCATION		
Quadrangle Name	Range	Section
Clear Lake	15E	16 & 21
Township Name	Nearest Town	
38N	Fremont, Indiana	

ACCESSIBILITY					
State owned public access site			Privately owned public access site		Other access site
In Michigan					
Surface acres	Maximum depth	Average depth	Acre feet	Water level	Extreme fluctuations
154	36 ft.	12 ft.	1,844	1038.66	None
Location of benchmark					

INLETS		
Name	Location	Origin

OUTLETS		
Name	Location	
Unnamed	Southwest corner (flows into Mirror Lake)	
Water level control		
POOL	ELEVATION (Feet MSL)	ACRES
TOP OF DAM		
TOP OF FLOOD CONTROL POOL		
TOP OF CONSERVATION POOL		
TOP OF MINIMUM POOL		
STREAMBED		
		Bottom type
		<input type="checkbox"/> Boulder
		<input type="checkbox"/> Gravel
		<input checked="" type="checkbox"/> Sand
		<input checked="" type="checkbox"/> Muck
		<input type="checkbox"/> Clay
		<input checked="" type="checkbox"/> Marl

Watershed use
General agriculture
Development of shoreline
80% residential
Previous surveys and investigations
USGS Hydrographic Survey, 1962. Michigan Department of Natural Resources, 1985. IDNR Fisheries Surveys:
Ledet, 1992.

SAMPLING EFFORT

ELECTROFISHING	Day hours		Night hours		Total hours
	N/A		0.75		0.75
TRAP NETS	Number of traps		Number of Lifts		Total effort
	1		3		3 lifts
GILL NETS	Number of nets		Number of Lifts		Total effort
	2		3		6 lifts
ROTENONE	Gallons	ppm	Acre Feet Treated	SHORELINE SEINING	Number of 100 Foot Seine Hauls

PHYSICAL AND CHEMICAL CHARACTERISTICS

Color	Dark green		Turbidity	
			7 Feet	6 Inches (SECCHI DISK)
Alkalinity (ppm)*			pH	
	Surface: 120.1	Bottom: 154.4	Surface: 9.2	Bottom: 9.0
Conductivity:	285 micromhos		Air temperature:	°F
Water chemistry GPS coordinates:				
	N 41.74567		W 84.80774	

TEMPERATURE AND DISSOLVED OXYGEN (D.O.)

DEPTH (FEET)	Degrees (°F)	D.O. (ppm)	DEPTH (FEET)	DEGREES (°F)	D.O. (ppm)	DEPTH (FEET)	DEGREES (°F)	D.O. (ppm)
SURFACE	70.4	9.8	36	45.8	0.1	72		
2	70.4	9.7	38			74		
4	70.3	9.9	40			76		
6	70.3	9.9	42			78		
8	69.3	9.9	44			80		
10	68.5	9.5	46			82		
12	67.0	9.5	48			84		
14	64.6	7.9	50			86		
16	62.1	6.0	52			88		
18	60.0	4.3	54			90		
20	57.2	2.2	56			92		
22	54.3	0.3	58			94		
24	51.1	0.1	60			96		
26	48.9	0.1	62			98		
28	47.6	0.1	64			100		
30	46.6	0.1	66					
32	46.2	0.1	68					
34	46.0	0.1	70					

COMMENTS

*ppm-parts per million

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF BLUEGILL									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0	2	0.7	0.01	1	19.0				
1.5	1	0.3	0.01	1	19.5				
2.0	1	0.3	0.01	1	20.0				
2.5	13	4.3	0.01	1,2	20.5				
3.0	26	8.6	0.01	2	21.0				
3.5	29	9.5	0.04	2,3	21.5				
4.0	36	11.8	0.06	3	22.0				
4.5	62	20.4	0.07	3,4	22.5				
5.0	38	12.5	0.10	3	23.0				
5.5	23	7.6	0.14	3,4	23.5				
6.0	18	5.9	0.18	3,4	24.0				
6.5	28	9.2	0.23	4,5	24.5				
7.0	21	6.9	0.28	4,5	25.0				
7.5	5	1.6	0.32	5,6	25.5				
8.0	1	0.3	0.39	5	26.0				
8.5					TOTAL	304			
9.0									
9.5									
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									
ELECTROFISHING CATCH		386.6 /hr		GILL NET CATCH	1.7 /lift		TRAP NET CATCH	1.3 /lift	

AGE-LENGTH KEY FOR BLUEGILL														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0	2	2	2											
1.5	1	1	1											
2.0	1	1	1											
2.5	13	4	7	6										
3.0	26	5		26										
3.5	29	5		23	6									
4.0	36	6			36									
4.5	62	6			52	10								
5.0	38	5			38									
5.5	23	3			15	8								
6.0	18	5			4	14								
6.5	28	5				22	6							
7.0	21	5				4	17							
7.5	5	2					3	2						
8.0	1	1					1							
Total	304	56	11	55	151	58	27	2						
Mean TL			2.6	3.4	4.9	96.2	7.2	7.8						
SE			0.12	0.05	0.05	0.10	0.07							

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF REDEAR									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5	1	0.5	0.09	3	22.5				
5.0	4	1.9	0.11	3	23.0				
5.5	13	6.0	0.14	3	23.5				
6.0	22	10.2	0.18	3,4	24.0				
6.5	21	9.8	0.22	3,4	24.5				
7.0	33	15.3	0.28	4	25.0				
7.5	58	27.0	0.34	4,5	25.5				
8.0	29	13.5	0.41	5	26.0				
8.5	25	11.6	0.48	5	TOTAL	215			
9.0	7	3.3	0.57	5,6					
9.5	2	0.9	0.64	6					
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	38.7 /hr	GILL NET CATCH	0.7 /lift	TRAP NET CATCH	60.7 /lift
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AGE-LENGTH KEY FOR REDEAR														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0														
1.5														
2.0														
2.5														
3.0														
3.5														
4.0														
4.5	1	1			1									
5.0	4	1			4									
5.5	113	4			13									
6.0	22	5			18	4								
6.5	21	5			13	8								
7.0	33	5				33								
7.5	58	5				46	12							
8.0	29	5					29							
8.5	25	4					25							
9.0	7	3					2	5						
9.5	2	1						2						
Total	315	39			49	91	68	7						
Mean TL					6.1	7.4	8.4	9.4						
SE					0.07	0.04	0.05	0.10						

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF YELLOW PERCH									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0					23.0				
5.5	4	1.9	0.09	3	23.5				
6.0	32	15.4	0.11	3	24.0				
6.5	43	20.7	0.14	3,4	24.5				
7.0	25	12.0	0.18	3,4	25.0				
7.5	31	14.9	0.23	3,4	25.5				
8.0	25	12.0	0.27	4	26.0				
8.5	18	8.7	0.33	4	TOTAL	208			
9.0	14	6.7	0.40	4					
9.5	8	3.8	0.47	4,5					
10.0	3	1.4	0.54	5					
10.5	2	1.0	0.62	5,6					
11.0	1	0.5	0.77	6					
11.5	1	0.5	0.84	6					
12.0	1	0.5	0.94	6					
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	41.3 /hr	GILL NET CATCH	29.0 /lift	TRAP NET CATCH	1.0 /lift
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AGE-LENGTH KEY FOR YELLOW PERCH														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0														
1.5														
2.0														
2.5														
3.0														
3.5														
4.0														
4.5														
5.0														
5.5	4	3			4									
6.0	32	5			32									
6.5	43	5			34	9								
7.0	25	5			10	15								
7.5	31	5			19	12								
8.0	25	5				25								
8.5	18	5				18								
9.0	14	5				14								
9.5	8	4				4	4							
10.0	3	2					3							
10.5	2	2					1	1						
11.0	1	1						1						
11.5	1	1						1						
12.0	1	1						1						
Total	208	49			99	97	8	4						
Mean TL					6.8	8.2	10.1	11.5						
SE					0.06	0.08	0.13	0.32						

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF LARGEMOUTH BASS									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5	1	0.7	0.02	1	21.5				
4.0	1	0.7	0.03	1	22.0				
4.5	1	0.7	0.05	1	22.5				
5.0	1	0.7	0.06	1	23.0				
5.5					23.5				
6.0					24.0				
6.5					24.5				
7.0	9	6.6	0.18	2	25.0				
7.5	5	3.6	0.22	2,3	25.5				
8.0	6	4.4	0.28	2,3	26.0				
8.5	24	17.5	0.32	3	TOTAL	137			
9.0	23	16.8	0.38	3					
9.5	14	10.2	0.45	3,4					
10.0	5	3.6	0.51	3,4					
10.5	13	9.5	0.60	3,4,5					
11.0	3	2.2	0.71	3,4					
11.5	2	1.5	0.79	3,4					
12.0	1	0.7	0.92	3,4,5					
12.5	5	3.6	1.01	4,5					
13.0	5	3.6	1.15	4,5					
13.5	3	2.2	1.29	4,5,6					
14.0	3	2.2	1.43	5,6					
14.5	1	0.7	1.62	5,6					
15.0	4	2.9	1.80	5,6,7					
15.5	3	2.2	1.96	5,6,7					
16.0	1	0.7	2.18	5,6					
16.5									
17.0									
17.5	1	0.7	2.75	6,7,8					
18.0	2	1.5	2.97	4,6,7					
18.5									

ELECTROFISHING CATCH	168.0 /hr	GILL NET CATCH	1.8 /lift	TRAP NET CATCH	0.0 /lift
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Species Largemouth bass	YEAR CLASS	NUMBER OF FISH AGED	SIZE RANGE	BACK CALCULATED LENGTH (inches) AT EACH AGE							
				I	II	III	IV	V	VI	VII	VIII
Intercept = 0.8	2007	4	4.0 - 5.7	4.8							
	2006	20	6.6 - 9.6	3.6	7.1						
	2005	60	7.5 - 12.1	4.0	7.1	9.0					
	2004	40	9.8 - 13.7	3.8	7.3	9.6	11.5				
	2003	46	10.9 - 18.1	4.1	7.5	10.1	12.4	14.0			
	2002	38	13.5 - 18.4	4.1	7.4	10.2	12.5	14.3	15.7		
	2001	22	15.1 - 20.7	4.1	7.8	10.8	13.2	15.2	16.7	17.9	
	2000	8	17.3 - 20.5	3.9	7.4	10.2	12.7	14.8	16.4	17.6	18.9
	AVERAGE LENGTH			4.0	7.3	9.8	12.3	14.4	16.1	17.8	18.9
	NUMBER AGED			238	234	214	154	114	68	30	8

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF GIZZARD SHAD									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0					23.0				
5.5					23.5				
6.0					24.0				
6.5					24.5				
7.0					25.0				
7.5					25.5				
8.0					26.0				
8.5					TOTAL	109			
9.0									
9.5									
10.0									
10.5									
11.0									
11.5									
12.0									
12.5	3	2.8	0.63						
13.0	27	24.8	0.71						
13.5	31	28.4	0.79						
14.0	27	24.8	0.88						
14.5	2	1.8	0.97						
15.0									
15.5	1	0.9	1.12						
16.0	7	6.4	1.30						
16.5									
17.0	5	4.6	1.55						
17.5	3	2.8	1.69						
18.0	2	1.8	1.83						
18.5	1	0.9	1.99						

ELECTROFISHING CATCH	8.0 /hr	GILL NET CATCH	14.3 /lift	TRAP NET CATCH	5.7 /lift
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NUMBER, PERCENTAGE, WEIGHT, AND AGE OF BLACK CRAPPIE									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0	1	1.2	0.02	1	21.0				
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0					23.0				
5.5	2	2.3	0.10	2	23.5				
6.0	2	2.3	0.12	2	24.0				
6.5					24.5				
7.0	7	8.1	0.20	3	25.0				
7.5	40	46.5	0.25	3	25.5				
8.0	22	25.6	0.29	3	26.0				
8.5	7	8.1	0.34	3	TOTAL	86			
9.0	1	1.2	0.43	3					
9.5	3	3.5	0.46	3					
10.0									
10.5									
11.0	1	1.2	0.75	5					
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									
ELECTROFISHING CATCH		0.0 /hr		GILL NET CATCH	13.8 /lift		TRAP NET CATCH		1.0 /lift

GPS SAMPLING COORDINATES											
GILL NETS				TRAP NETS				ELECTROFISHING			
1	N	41.74852	W 84.80995	1	N	41.74410	W 84.81505	1	N		W
	N		W	2	N	47.74467	W 84.81416		N		W
2	N	41.74769	W 84.80160	3	N	41.74489	W 84.80273	2	N		W
	N		W	4	N		W		N		W
3	N	41.74932	W 84.81065	5	N		W	3	N		W
	N		W	6	N		W		N		W
4	N	41.74892	W 84.80055	7	N		W	4	N		W
	N		W	8	N		W		N		W
5	N	41.74673	W 84.81230	9	N		W	5	N		W
	N		W	10	N		W		N		W
6	N	41.74426	W 84.80504	11	N		W	6	N		W
	N		W	12	N		W		N		W
7	N		W	13	N		W	7	N		W
	N		W	14	N		W		N		W
8	N		W	15	N		W	8	N		W
	N		W	16	N		W		N		W
9	N		W	17	N		W	9	N		W
	N		W	18	N		W		N		W
10	N		W	19	N		W	10	N		W
	N		W	20	N		W		N		W
11	N		W					11	N		W
	N		W						N		W
12	N		W					12	N		W
	N		W						N		W
13	N		W					13	N		W
	N		W						N		W
14	N		W					14	N		W
	N		W						N		W
15	N		W					15	N		W
	N		W						N		W
16	N		W					16	N		W
	N		W						N		W
17	N		W					17	N		W
	N		W						N		W
18	N		W					18	N		W
	N		W						N		W
19	N		W					19	N		W
	N		W						N		W
20	N		W					20	N		W
	N		W						N		W

Occurrence and Abundance of Submersed Aquatic Plants

Lake: Little Long Lk	Secchi(ft): 6.0	SE Mean species / site: 0.25
Date: 7/15/2008	Littoral sites with plants: 42	Mean natives / site: 1.96
Littoral Depth (ft): 12.0	Number of species: 15	SE Mean natives / site: 0.25
Littoral Sites: 42	Maximum species / site: 8	Species diversity: 0.87
Total Sites: 50	Mean species / site: 2.12	Native diversity: 0.85

Species	Frequency of Occurrence	Score Frequency				Dominance
		0	1	3	5	
Coontail	50.0	50.0	40.0	8.0	2.0	14.8
Eel grass	36.0	64.0	36.0	0.0	0.0	7.2
Large-leaf pondweed	28.0	72.0	8.0	10.0	10.0	17.6
Chara	22.0	78.0	12.0	6.0	4.0	10
Slender naiad	16.0	84.0	16.0	0.0	0.0	3.2
Curly-leaf pondweed	14.0	86.0	14.0	0.0	0.0	2.8
Flat-stemmed pondweed	14.0	86.0	14.0	0.0	0.0	2.8
Northern watermilfoil	8.0	92.0	8.0	0.0	0.0	1.6
Elodea	6.0	94.0	6.0	0.0	0.0	1.2
Variable pondweed	6.0	94.0	6.0	0.0	0.0	1.2
Water stargrass	4.0	96.0	4.0	0.0	0.0	0.8
Bladderwort	2.0	98.0	0.0	2.0	0.0	1.2
Eurasian watermilfoil	2.0	98.0	2.0	0.0	0.0	0.4
Spiny naiad	2.0	98.0	2.0	0.0	0.0	0.4
Star duckweed	2.0	98.0	2.0	0.0	0.0	0.4

Other species noted: Arrowhead, cattail, purple loosestrife, spatterdock and white waterlily